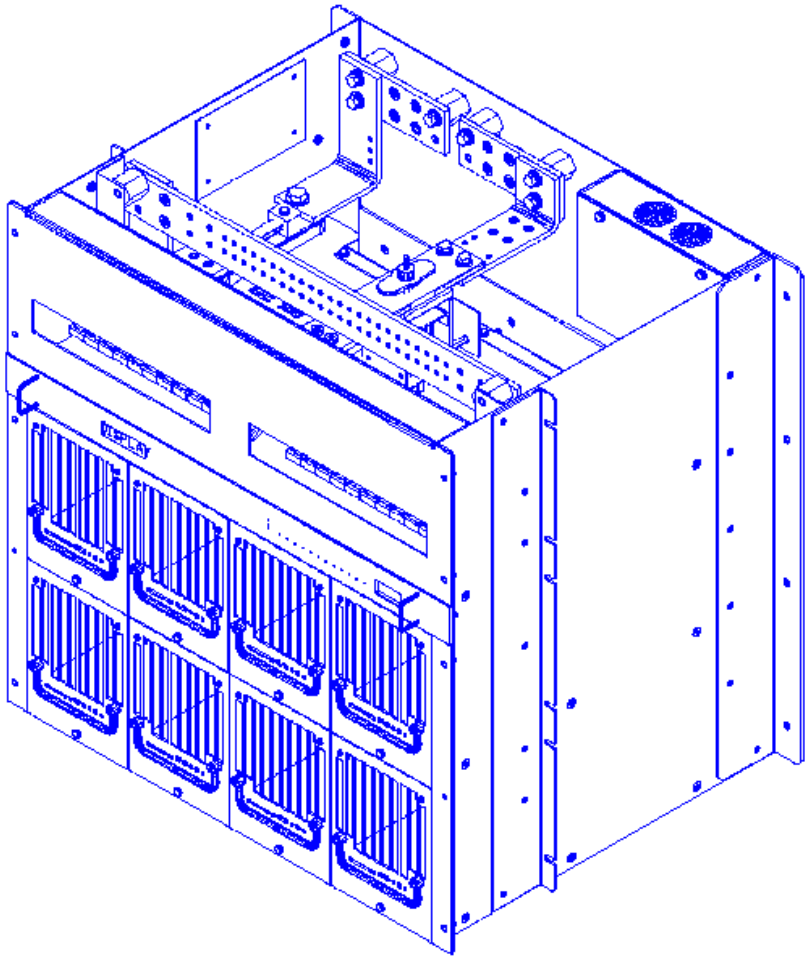
www.apcc.com

**Doc # PML-0209**

**Revision Level: A**

# DC POWER PLANT
# PRODUCT MANUAL
# MODEL MX28B



American Power Conversion
11035 Switzer Avenue
Dallas, TX  75238
214-342-5000

December, 1999

# REVISION HISTORY

| Revision | Date | By | Description |
|---|---|---|---|
| A | 12/16/99 | BGL | Initial release. |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# TABLE OF CONTENTS

# 1. GENERAL INFORMATION

## 1.1 Introduction

DC Power Systems from APC have unique features that make them easy to install, maintain, and upgrade. The rectifier units are modular and truly “hot-pluggable” into the shelf assembly without any separate ac wiring.

All system settings are made from the system control unit that provides monitoring and control functions for each component of the system as well as alarm listings for system diagnosis and maintenance.

The APC international network of sales and service offices and qualified representatives provides sales assistance for proposals, purchases, and after-sales support.

**APC provides nationwide 24-hour, 7-day service response by dialing:**

**(800) 727-8695**

This service will answer your call, gather specific service information, and have a qualified APC service representative contact you as quickly as possible (refer to section on customer service and support).

## 1.2 Precautions

**It is extremely important to read, understand, and strictly follow the instructions in sections on installation and setup. Also, please note the special SAFETY PRECAUTIONS outlined in Section** 5.1.4 **before beginning actual installation of the power system.**

If any precautions are not clearly understood, or local conditions are not covered, contact the nearest APC representative or APC at (214) 342-5000 for clarification.

Also, refer to all applicable federal, state, and local regulations, and industry guidelines for correct installation of this power system.

## 1.3 Inspection upon Receipt of Goods

### 1.3.1 General

APC has taken precautions in packing the power equipment for shipment to ensure its safe arrival; however, the entire shipment including any boxes or crates should be inspected upon receipt for evidence of damage that may have occurred during transit.

### 1.3.2 Visible External Damage

It is the responsibility of the person receiving the shipment to inventory and inspect all materials against the bill of lading or waybill provided **IMMEDIATELY** upon taking delivery while the carrier representative is **STILL ON SITE**. Please be sure that all items are accounted for, including the correct number of pallets and the quantity of accessory and/or component boxes. Also, note any visible external damage that may have occurred during transit.

If damage has occurred or the quantity of items is not correct, then:

1) Make a descriptive notation on the delivery receipt before signing.

2) File a damage or shortage report with the carrier that delivered the shipment.

### 1.3.3 Concealed Damage

It is the customer's responsibility to unpack the power system and equipment received from APC and check for concealed damage. Within 15 days of receipt, check the materials received against the detailed packing list to verify that the quantity and condition are complete and satisfactory.

Again, note any damage to the internal packing material and/or material shortages. If damage or shortage is noted, then:

1) Request an inspection by the carrier;

2) File a concealed damage claim; and/or

3) File a material shortage claim with your APC representative.

**DELAY IN NOTIFYING THE CARRIER MAY RESULT IN LOSS OF RIGHT TO REIMBURSEMENT FOR DAMAGES OR LOSS.**

If you are unsure about the appearance of a part while conducting the materials inventory and inspection, refer to the manual or contact the Customer Service Department of APC.

**Should you have any questions concerning potential damages or should you experience a lack of cooperation from your carrier, please contact your APC representative, or call APC.**

### 1.3.4 Return of Damaged Goods

Should equipment be damaged and require return to APC for repair, the APC service representative will provide instructions along with a valid returned material authorization (RMA) number to facilitate return of the damaged goods to the APC repair center.

It is important that the steps outlined in Section 1.3.2 and Section 1.3.3 above are followed carefully. Your APC representative will assist you, if required, in obtaining proper disposition of an initial delivery return issue; however, a valid RMA number must be obtained before returning any equipment to APC.

# 2. CUSTOMER SERVICE AND SUPPORT

APC manufactures a line power plants and provides customers with complete product and systems support and service. APC has an international network of factory trained service technicians. The service organization is on call 24 hours a day, 365 days a year.

**If there is a problem with the power system, contact APC at**

**(800) 727-8695**

**Units returned for repair can be turned around within 24 to 48 hours of receipt at the factory location. Shipment should be sent pre-paid. The unit will be returned pre-paid provided it was received that way.**

An RMA must be obtained for all equipment returned to APC. It is important that correct procedures be followed in filing an RMA, including providing an accurate written description of the problem. An accurate written problem description will help ensure that the unit will be properly repaired.

If a unit is returned and a “No Fault Found” results, APC reserves the right to bill the customer for labor and assess a service charge to cover extra costs incurred.

# 3. WARRANTY PROVISIONS

## 3.1 General Provisions

APC warrants the power equipment and components it manufactures or sells against defective materials and workmanship for a period of TWO (2) YEARS from the date of shipment.

### 3.1.1 Warranty Returns

If initial physical inspection results in identification of a material or workmanship flaw(s) that could impair product performance as defined by Advance Power's electrical and physical specification in effect at the time of shipment, and if this flaw(s) is not due to transportation damage or installation abuse, contact Advance Power, Inc. or call the 24-hour emergency number, (800) 727-8695, to request assistance.

You will be provided either a) an RMA number with instructions for return of the equipment or component(s) to the Advance Power, Inc. factory service center, FOB destination, freight pre-paid, for examination, or b) for non-returnable systems and equipment, notice to wait until an Advance Power, Inc. authorized service representative arrives at the site to inspect the equipment. Repaired or advance replacement modules or circuit components will normally be available within 24 to 48 hours of receipt of equipment or RMA.

### 3.1.2 Warranty Repair or Replacement

If, during the warranty period, the supplied equipment is found to be physically or electrically faulty due to defective materials or workmanship on the part of Advance Power, Inc., the defective product(s) or component(s) will be repaired or replaced at the sole option of Advance Power, Inc. without charge to the user for replacement materials or repair labor. (The procedure outlined above for contacting Advance Power, Inc. must be followed.) Costs incurred for replacement installation including, but not limited to, installation equipment, travel expenses of an Advance Power, Inc. representative(s), and costs of installation material transportation expenses are not the responsibility of Advance Power, Inc. Any replacement product(s) or component(s) shall only complete the remaining unused portion of the original warranty of the replaced product(s) or component(s).

## 3.2 Exclusions and Limitations

1. This warranty applies only to the original US domestic purchaser (user) and is not transferable internationally, except with expressed written consent from Advance Power, Inc. headquarters in Dallas, Texas.
2. Advance Power, Inc. reserves the right to void the warranty if identification marks or serial numbers have been removed or tampered with, or the defect is determined to have been caused by misuse, neglect, improper installation, environmental conditions, non-authorized repair, alteration, or accident.
3. This warranty does not cover physical damage due to the acts of nature or man that stress the equipment or component(s) beyond design limits and exert undesirable influence aside from normal wear and tear.

4. Advance Power, Inc. assumes no responsibility for any work accomplished or expenses incurred except with expressed written consent from Advance Power, Inc.

5. Advance Power, Inc. shall not be liable to the user (purchaser) or any third party for indirect, incidental, or consequential damages such as, but not limited to, loss of use, loss of profits, costs associated with removal/installation of a defective product(s) or component(s) arising out of the sale or relating to the use of this product, and the user (purchaser) assumes responsibility for all personal injury and property damage resulting from the handling, possession, or use of the product. In no event shall the liability of Advance Power, Inc. for any and all claims, including claims of breach of warranty or negligence, exceed the purchase price of the product that gave rise to the claim.

The above warranty is in lieu of all other remedies, including actions for contract or negligence.

**All other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose, are hereby excluded.**

# 4. PRODUCT OVERVIEW AND TECHNICAL DESCRIPTION

## 4.1 Description

The Advance Power, Inc. Model MX28B is a modular stand-alone -48V dc power plant. It is configurable in such a manner that it will support most typical applications within the specified current ranges (either 200 or 400 amperes) without special application engineering or assistance. Distribution is included for up to 24 plug-in circuit breakers. These circuit breakers can be 1 to 100 amps, with 60-100 amp breakers requiring two positions and a circuit breaker adapter kit. An optional low voltage disconnect (LVD) can be provided on either the battery or the load side. A 400 amp MX28B is shown in Figure 4.1-1. A block diagram is shown in Figure 4.1–2.

**Figure 4.1-1. 400 Amp MX28B**

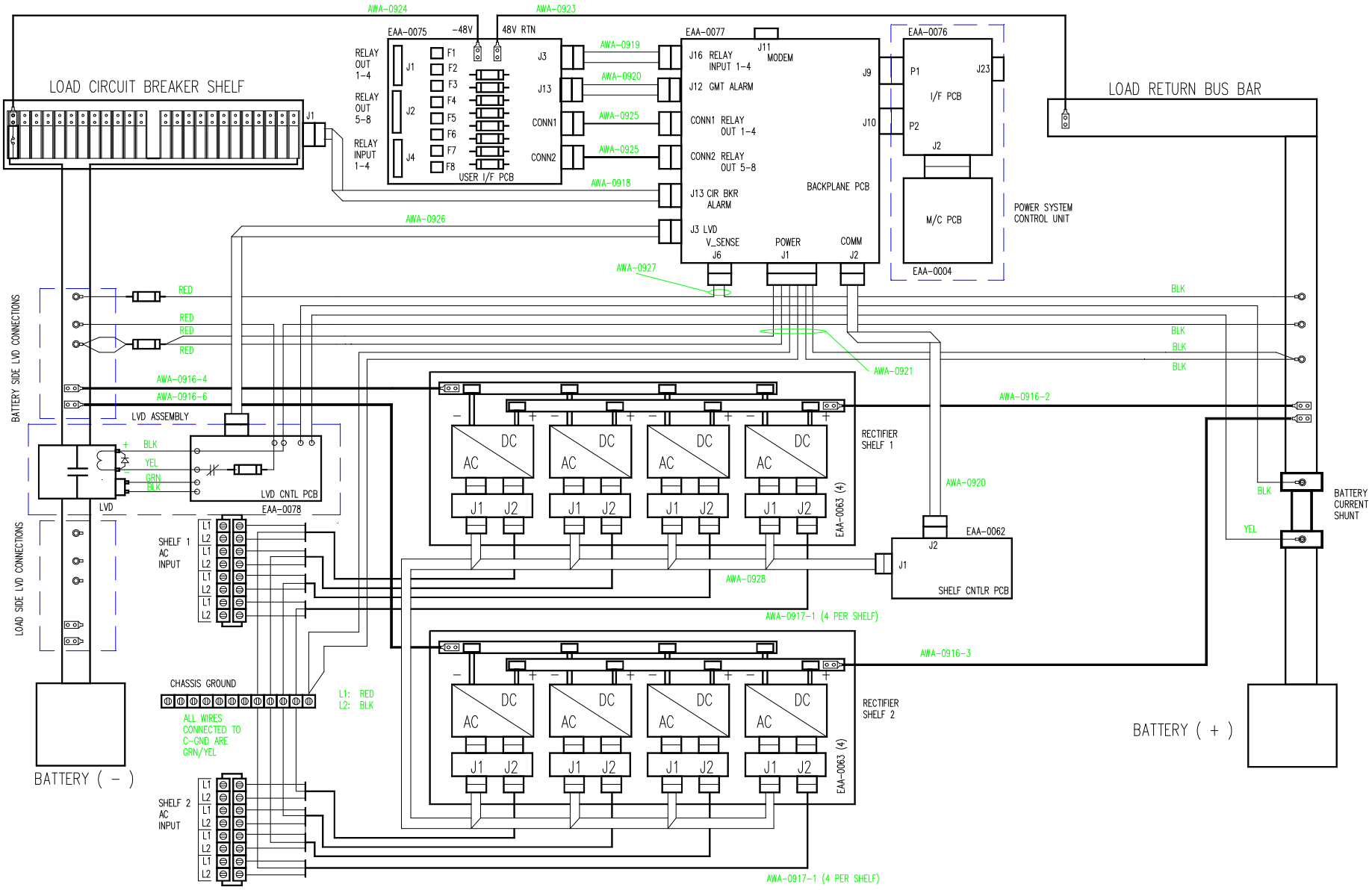



**Figure 4.1-2. MX28B BLOCK DIAGRAM**

## 4.2 Power Output Capacity

The power plant has two basic configurations:

The first supplies a maximum of 200 amps or 150 amps with N+1 redundancy. The housing for this configuration provides space for one rectifier shelf that can hold up to four rectifiers, a control unit, and one tier of up to 24 distribution circuit breakers.

The second supplies a maximum of 400 amps or 350 amps with N+1 redundancy. The housing for this configuration provides space for two rectifier shelves that can hold up to four rectifiers each, a control unit, and one tier of up to 24 distribution circuit breakers.

The difference between the 200 and 400 amp units are the side plates and an additional rectifier shelf; all other parts are the same for both configurations.

## 4.3 Rectifiers

The rectifiers are Advance Power, Inc. Model MRF28H54BV with specifications as follows:

- Input Voltage: 176-264V ac (230V ac nominal) @ 45-66 Hz
- Input Current per Rectifier: 13.9 Amps @ 230V ac
- Apparent Power Factor: 99% Typical, 98% Minimum
- Output Voltage: 54.5V dc
- Overvoltage Protection: Set at 59.5V dc
- Output Current per Rectifier: 50 Amps Minimum Continuous
- Power Output per Rectifier: 2800W Continuous, Vin > 198V ac
- Efficiency: 91% Typical
- Cooling: Fan cooled, front to rear airflow
- Ambient Temperature: -25°C to 65°C Operational

## 4.4 Control Unit

The microprocessor-based power system control unit is 1U high (1.75”) and provides control and monitoring functions. Features implemented are:

- 32-character alphanumeric display
- LED alarm and status indicators
- Standard voltage and battery charging control
- Battery temperature compensation (optional)
- Monitoring of up to two shelves of four rectifiers each
- Individual alarm monitoring of 24 breakers
- Eight alarm / annunciation relays (Major, Minor, and six user defined) with form C contact outputs
- Four external alarm inputs (either N.O. or N.C. contacts)

- Control of either a battery or a load LVD

## 4.5 AC Input Power

Each rectifier requires 208/220/240V ac, single-phase, 50/60 Hz, supplied through an external 20-amp two-pole breaker. A rear located enclosure, with two holes for customer-supplied one-inch conduit entry, provides a terminal strip(s) for ac input power connection and a separate “Earth Ground” bar for connection of the safety ground wire(s).

## 4.6 Battery connections

Top entry battery connections are made at the top rear of the unit (see Figure 4.6-1). The -48V and return buses each provide two sets of threaded 3/8”-16 holes on one-inch centers for connecting two-hole battery cable lugs.

A battery disconnect breaker is required external to this equipment. The power plant can monitor auxiliary contacts from this breaker.

Battery temperature compensation is available. Advance Power’s standard temperature monitor sensor and cable is used to implement this optional function.

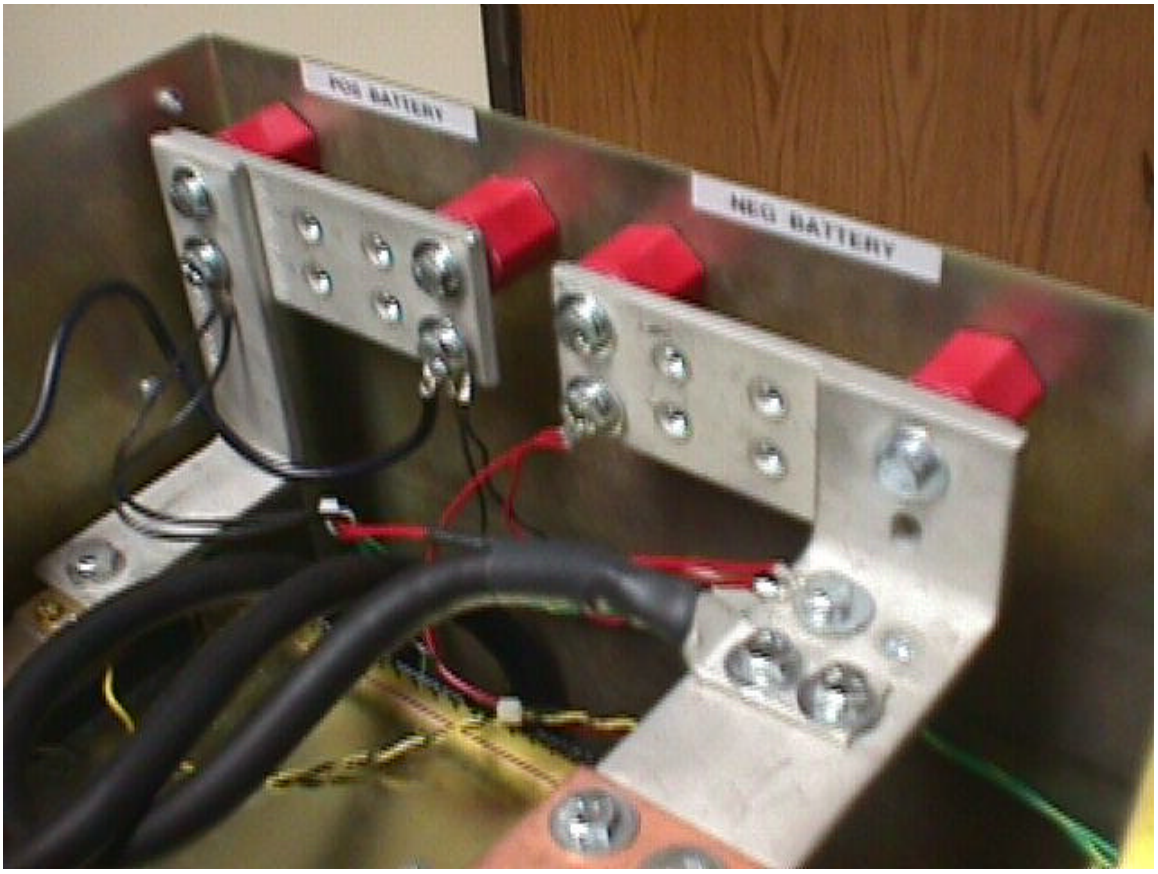



**Figure 4.6-1. Battery Cable Connection Locations**

## 4.7 DC Distribution

A standard 24-position plug-in circuit breaker tier provides -48V distribution. The breaker tier is connected at its center to the -48V dc bus, and each side has an ampacity of 300A. Connections for -48V dc loads, requiring standard #10-32 two-hole lugs on 5/8-inch centers, are located directly above the corresponding breaker. The load returns connect to the return bus, which accommodates 24 two-hole #10-32 lugs on 5/8-inch centers, and four two-hole ¼"-20 lugs on ¾-inch centers. The return bus also provides a pair of threaded 3/8"-16 holes on 1-inch centers for connection of a cable to the master station ground. Figure 4.7-1 shows the power plant's dc distribution section with the front cover removed.

Eight GMT fused outputs are also available as an option. This option uses one of the 24 available circuit breaker positions.

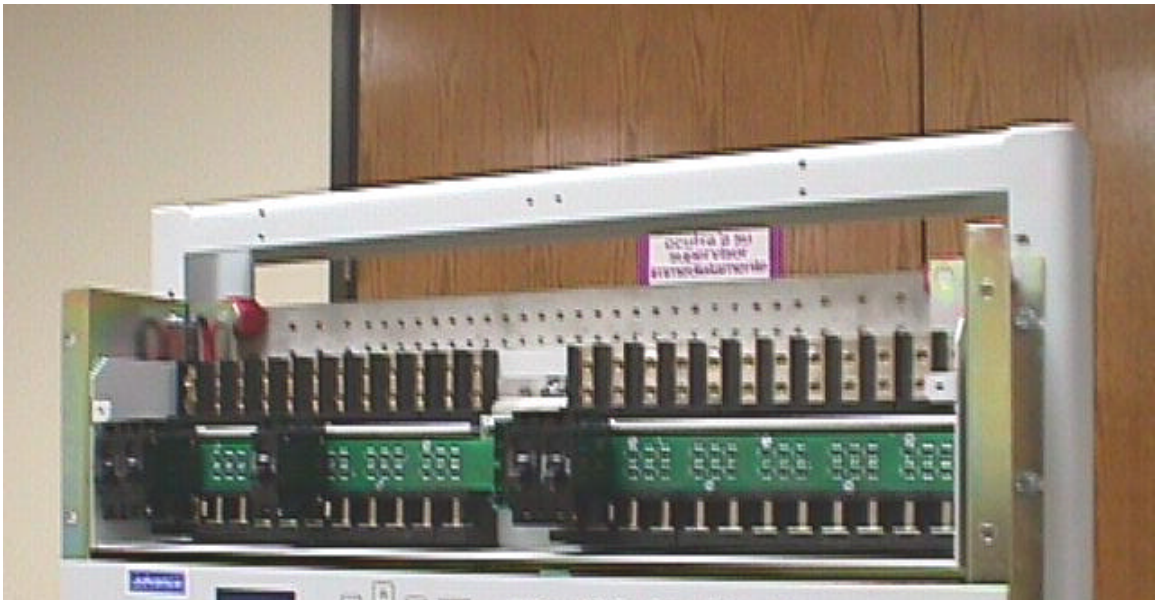


**Figure 4.7-1. DC Distribution (Front Cover Removed)**

## 4.8 Mounting

Both front mounting on standard 2-inch rails and optional wall mounting are available.

## 4.9 Environmental

| | |
|---|---|
| Ambient Temperature: | -20°C to +65°C operating<br>-40°C to +85°C storage |
| Humidity: | 0% to 85% RH non-condensing operating<br>0% to 95% RH non-condensing storage |
| Altitude: | Up to 3000m, operating<br>Up to 10,000m, storage |

## 4.10 Mechanical

| | |
|---|---|
| Dimensions: | 15.75” high x 23” wide x 17.5” deep (200 amp unit)<br>22.75” high x 23” wide x 17.5” deep (400 amp unit) |
| Weight: | Housing - 85 lbs. (200A); 110 lbs. (400A)<br>Rectifier - 11 lbs. |
| Color: | Dawn Gray (fronts) |

## 4.11 Compliance

UL 1950

FCC Part 15, Class A

# 5. INSTALLATION PROCEDURES

## 5.1 Preparation

### 5.1.1 Recommended Tools

- Standard selection of insulated hand tools.
- Proper tools for crimping the selected cable lugs.

### 5.1.2 Recommended Test Equipment

- Digital Multimeter

### 5.1.3 Equipment Inspection

Remove equipment from packing material and inspect for shipping damage to verify the safety and operational suitability for the installation site. *[Refer to Section 1.3]*

### 5.1.4 Safety Precautions

******* WARNING *******

**The MX28B dc power plant is supplied from a nominal 220V ac, 60 Hz source. Keep the ac input enclosure cover in place when the system is operational or energized.**

******* WARNING *******

**Hazardous energy levels are present on bare conductors in the -48V dc distribution connection area of the plant. Accidental shorting of distribution conductors can cause arcing and high currents that can cause serious burns or other physical harm.**

**It is recommended that:**

- **Any jewelry, rings or watches be removed while working on this equipment.**
- **Handles of all wrenches, screwdrivers, cutters and pliers be insulated.**
- **Shafts of screwdrivers be wrapped in electrical tape or otherwise insulated.**

### 5.1.5 Room/Locations

**NOTE: The Advance Power, Inc. Model MX28B dc power plant is to be installed in a room, vault, or similar enclosure that is accessible only to qualified persons in accordance with the NEC or the authority having jurisdiction.**

Prior to installation, drawings, floor loading requirements, external alarm points, ac service entrance, and grounding schemes should all be checked and confirmed. If batteries are to be mounted in a room separate from the power plant, careful attention should be paid to battery cable voltage drop effects. Environmental operating temperatures and ventilation/cooling considerations should also be noted, not just for the power system but for all other equipment that may reside in the power room area.

### 5.1.6 Mounting

Both front mounting on standard 23-inch rails and optional wall mounting are available.

### 5.1.7 Ventilation

The rectifiers have fans that provide front to rear airflow for internal cooling. The MX28B housing should mounted such that there is free airflow to the front, top, and bottom of the unit. *[Refer to Section 4.9 for environmental characteristics.]*

## 5.2 AC Service and Ground Connections

******* WARNING *******

**Ensure that all of the dc and external ac circuit breakers are in the OFF position prior to connecting service to the power plant. Confirm that all voltages have been removed including any battery sources before proceeding.**

The MX28B dc power plant requires the supply of 208/220/240V ac, single-phase, 50/60 Hz power through individual external 20-amp two-pole circuit breakers to the ac input terminal block connections for each rectifier in the system. (The ac wiring, from the ac input terminal block connections to the hot-pluggable ac input connector for each rectifier, is factory installed.)

The ac input enclosure, located at the top right rear of the MX28B housing, is provided with two one-inch conduit entry holes and an access cover. Inside, a terminal strip(s) for ac input power connection and a separate “Earth Ground” bar for connection of the safety ground wire(s) are provided. The terminal block(s) is labeled as Position 1 through Position 4 (Position 1 through Position 8 for the 400-amp unit) with each position having inputs designated “L1” and “L2” for connection of the two ac wires. Positions 1-4 correspond to the top rectifier shelf positions from left to right. Positions 5-8 are applicable to the 400-amp unit only and correspond to the lower rectifier shelf positions from left to right.

The suggested wire size is #10 AWG rated at 90°C or higher; however, the ambient temperature and number of wires in a conduit must also be considered in accordance with NEC requirements. It is suggested that feeds for four rectifiers (8 wires) and one safety ground wire be run in a one-inch conduit; however, be sure to follow any local electrical wiring codes.

If the ac input power is provided from a three-phase distribution panel, the circuit breaker positions should be selected such that the load is balanced as much as possible.

## 5.3 Battery Connections

### 5.3.1 Battery Disconnect

An external circuit breaker (not supplied) is required in the negative line (located at the battery end) to protect the cables from the battery to the MX28B dc power plant. The power plant can monitor auxiliary contacts from this breaker.

### 5.3.2 Cable Sizing Considerations

The battery cable(s) should be sized sufficiently large to limit the voltage drop from the MX28B dc power plant to the battery during charging per system design requirements. The

cable(s) must also carry the full load current during battery operation. If assistance is required to determine the necessary cables for the application, contact your sales representative or Advance Power, Inc.

### 5.3.3 Connecting the Cables

The battery cable connections are located at the top rear of the unit as shown in Figure 4.6-1. The battery positive (return bus) and battery negative (-48V bus) buses each provide two sets of threaded 3/8”-16 holes on one-inch centers for connecting two-hole battery cable lugs. Connect the battery cables as applicable using 3/8”-16 bolts (not provided) and tighten them with a torque wrench to 200 in-lbs.

******* CAUTION *******

**Make certain that the battery polarity is correct when making connections to the Model MX28B dc power plant. Incorrect connection could cause severe equipment damage.**

## 5.4 DC SYSTEM GROUNDING

**THE POSITIVE BATTERY CONNECTION (RETURN BUS) FOR THE POWER PLANT MUST BE CONNECTED TO THE MASTER STATION GROUND. THE LEFT END OF THE RETURN BUS PROVIDES A PAIR OF THREADED 3/8”-16 HOLES ON 1-INCH CENTERS FOR CONNECTION OF A TWO-HOLE LUGGED CABLE TO THE MASTER STATION GROUND. DETAILS FOR THIS CONNECTION SHOULD BE PROVIDED IN THE SITE ELECTRICAL GROUNDING PLAN.**

## 5.5 Rectifier Installation

The Advance Power, Inc. Model MRF28H54BV rectifiers are shipped in separate containers. Follow the procedure below to install a rectifier.

1) Remove the rectifier from its shipping container.

2) Remove the rectifier retaining screw from the shelf position where the rectifier is to be installed.

3) Slide the rectifier into the shelf between the guides until it is fully seated.

4) Fasten the rectifier in place with the rectifier retaining screw.

Since all adjustments are made from the system control unit, no rectifier adjustments are necessary.

## 5.6 Alarm Connections

The alarm connections for all rectifiers, breakers, and fuses are factory pre-wired. The MX28B dc power plant, however, permits the user to program the system alarms in various ways.

### 5.6.1 External Alarm Inputs

Four external alarm inputs with assignable priority levels are available. These alarm inputs respond to external dry contact closures between normally open (NO) and common (C) or contact openings between normally closed (NC) and C (see Table 5.6-1).

| External Alarm Source (non-alarm state) | Connect To Input Alarm Terminals |
|---|---|
| OPEN<br>CLOSED | NO-C<br>NC-C |

**Table 5.6-1. External Alarm Input Definition**

Table 5.6-2 shows the external alarm input connection designations. Connector J4 is located on the interface card mounted in the top left side of the unit. Systems are shipped with jumper wires connecting each NC and corresponding C contact. A jumper wire should be removed only if the corresponding NC-C contacts are going to be used.

| EXTERNAL ALARM INPUT | J4 TERMINAL DESIGNATION (NO-NC-C) | USER ALARM NOTES |
|---|---|---|
| #1<br>#2<br>#3<br>#4 | NO1-NC1-C1<br>NO2-NC2-C2<br>NO3-NC3-C3<br>NO4-NC4-C4 | _____<br>_____<br>_____<br>_____ |

**Table 5.6-2. External Alarm Input Connections**

### 5.6.2 Alarm Outputs

There are eight alarms available that provide outputs via Form “C” relay contacts. The last two of these are preassigned as the Minor and Major alarm outputs. The Major relay is energized (NO-C contacts closed) during normal (non-alarm) operating conditions; all the other relays energize when an alarm condition occurs. The other six outputs are initially designated as “Relay 1” through “Relay 6” (the user may assign more meaningful names if desired). The various system alarm conditions can be assigned to any of the eight alarm outputs.

Table 5.6-3 shows the alarm output connection designations. Connectors J1 and J2 are located on the interface card mounted in the top left side of the unit. The relay contacts should only be used to switch resistive loads of 0.5 amperes or less at 60 volts or less.

| ALARM OUTPUT | TERMINAL DESIGNATION NO-NC-C | USER ALARM NOTES |
|---|---|---|
| | J1 | |
| RELAY #1 | NO1-NC1-C1 | _____ |
| RELAY #2 | NO2-NC2-C2 | _____ |
| RELAY #3 | NO3-NC3-C3 | _____ |
| RELAY #4 | NO4-NC4-C4 | _____ |
| | J2 | |
| RELAY #5 | NO5-NC5-C5 | _____ |
| RELAY #6 | NO6-NC6-C6 | _____ |
| MINOR | NO7-NC7-C7 | |
| MAJOR | NO8-NC8-C8 | |

**Table 5.6-3. Alarm Output Connections**

## 5.7 Connecting The Loads

### 5.7.1 DC Circuit Breakers and Fuses

Both plug-in circuit breakers and GMT fuses can be installed in the MX28B power plant for dc distribution circuit protection. Available plug-in circuit breakers are shown in Table 5.7-1. Plug-in circuit breakers rated at 60A or more require two mounting positions and require a breaker adapter kit, which is included (see kit selection information below the table). The breaker adapter kit includes all necessary mounting hardware.

| BREAKER RATING | PART NUMBER |
|---|---|
| 1 A | FFA-0014 |
| 3 A | FFA-0015 |
| 5 A | FFA-0016 |
| 10 A | FFA-0017 |
| 15 A | FFA-0028 |
| 20 A | FFA-0018 |

| BREAKER RATING | PART NUMBER |
|---|---|
| 40 A | FFA-0020 |
| 50 A | FFA-0025 |
| 60 A | FFA-0021-X * |
| 70 A | FFA-0022-X * |
| 80 A | FFA-0023-X * |
| 100 A | FFA-0024-X * |

| | | | |
|---|---|---|---|
| 30 A | FFA-0019 | | |

* -1: adapter has #10 studs on 5/8” centers for two-hole cable lug
-2: adapter has #10 studs on ¾” centers for two-hole cable lug
-3: adapter has ¼” studs on 1” centers for two-hole cable lug

**Table 5.7-1. Plug-in Circuit Breakers**

A list of GMT type fuses available from Advance Power, Inc. is provided in Table 5.7-2.

| FUSE RATING | PART NUMBER |
|---|---|
| 1/4 A | FFA-0030 |
| 1/2 A | FFA-0031 |
| 3/4 A | FFA-0032 |
| 1 A | FFA-0033 |
| 1¼ A | FFA-0039 |
| 1½ A | FFA-0035 |
| 3 A | FFA-0036 |
| 5 A | FFA-0037 |
| 10 A | FFA-0038 |

**Table 5.7-2. GMT Fuses**

### 5.7.2 Installation of Circuit Breakers and Fuses

#### 5.7.2.1 Plug-in Circuit Breakers

1) Remove the circuit breaker cover panel and the plastic cover(s) from the desired location(s).

**2)** Install the circuit breaker(s) by snapping the top terminal onto the upper bus bar and rotating the unit down until the second terminal snaps onto the breaker termination post as shown in Figure 5.7-1. The breaker alarm terminals are designed to make contact with the alarm terminal board as the breaker is snapped into place.

**NOTE: Circuit breaker alarm contacts close when the circuit breaker is tripped but not when it is turned OFF.**

******* CAUTION *******

During circuit breaker installation, carefully align the breaker alarm terminals with the alarm terminal board to avoid breaker terminal damage.

3) Reattach the circuit breaker cover panel.

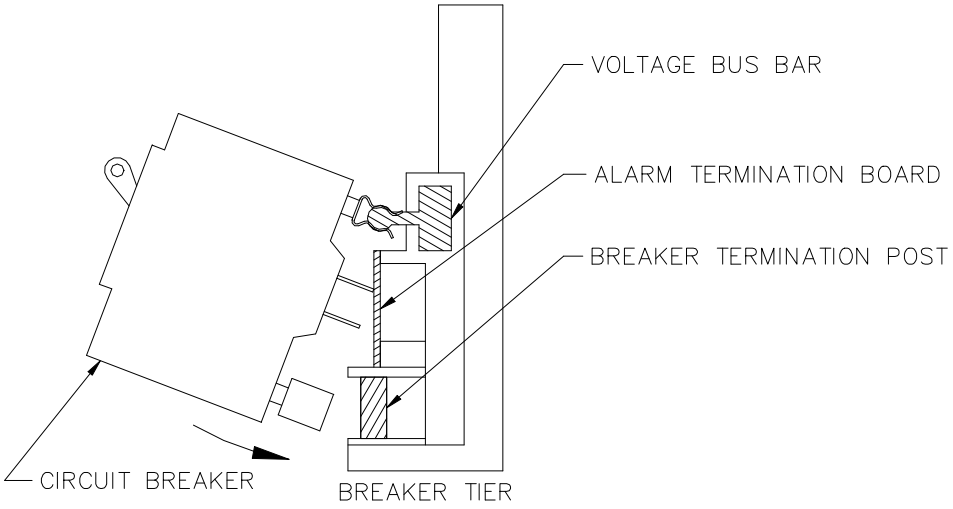



**Figure 5.7-1. Installation of Circuit Breakers**

### 5.7.2.2 GMT Fuses

Fuseholders that accommodate GMT fuses are located on the interface card mounted in the top left side of the unit. These fuseholders are only connected to -48V dc if the system has been purchased with the GMT fuse option. This option supplies -48V dc to the fuseholders through a 50 A. circuit breaker located in circuit breaker Position 1. The interface card provides fuseholders for eight fuses, labeled “F1” through “F8”, which can be used for small -48V dc loads. The maximum fuse size that should be used is 10A.

### 5.7.3 Load Connections

### 5.7.3.1 Circuit Breakers

Connections for -48V dc loads require standard two-hole lugs for #10 screws on 5/8” centers and are located directly above the corresponding circuit breaker. The load returns connect to the return bus located just above and rearward of the breaker connection points

as seen in Figure 5.7-1. The return bus provides 24 sets of threaded #10-32 holes on 5/8" centers and four sets of threaded ¼"-20 holes on ¾" centers for connection of two-hole lugs on load return wires.

#### 5.7.3.2 GMT Fuses

Connections to the GMT fuses are made at terminal block connectors labeled "F1" through "F8" that are located on the interface card mounted in the top left side of the unit. Each connector has two positions, labeled "-48V" and "RTN", for connection of the -48V dc load and load return wires.

## 5.8 Battery Temperature Probe Installation

The optional temperature probe is used to monitor the battery string temperature. To get the most representative temperature measurement, the probe should be placed in contact with a battery cell that is centrally located. The probe should be placed directly in contact with the cell (not the frame surrounding the cell). Generally, the cell cover can be used; be careful not to allow the probe body to touch the terminals.

1) Plug the connector end of the temperature probe into J5 the control unit backplane card.

2) Route the cable as required to position the probe on the selected battery cell

3) Remove the adhesive protection strip from the probe body and press the adhesive side of the probe on the battery cell cover.

## 5.9 Power-Up and Checkout

Before initiating power-up and checkout, ensure that the following conditions exist:

1) Make sure that the external circuit breaker protecting the cables from the battery to the power plant is turned **OFF** (the battery cables should be connected to the power plant, but the battery should **not** be connected).

2) Make sure that all load circuit breakers are turned **OFF** (including the one feeding the GMT fuses if the unit has the GMT fuse option).

3) Verify that all rectifiers have been installed.

### 5.9.1 Apply AC Power

Turn on the circuit breakers that supply ac power to the rectifiers in the MX28B dc power plant. The main screen should appear on the control unit display (see Figure 5.9-1). The display on the control unit is a 2-lines by 16-characters display. The cursor cycles below the characters of the active selection on the display. Information shown in the second line of Figure 5.9-1 that extends beyond 16 characters (to the right of the "S" in "ALARMS") can viewed on the control unit display by using the scrolling controls (refer to Section 6 for operation of the control unit).

NOTE: When ac power is initially applied, there is a 60-second period during which no alarms are reported.

**MX28B +**
**STATUS ALARMS SYSTEM MODULES BATT PIN OEM**

**Figure 5.9-1**

### 5.9.2 System Parameters Verification/Adjustment

The MX28B system control unit is delivered with pre-programmed parameter default settings. A complete listing and description of all system configuration parameters as well as displayable system status and information is provided in Section 6. Read Section 6 to gain an understanding of and how to use the operational features provided by the MX28B dc power plant. As a minimum, the following parameters should be verified and adjusted, if required, before connecting batteries or loads to the power plant:

1) **Battery Float Voltage** - default = -54.00V dc (Check the manufacturer's recommendation for the batteries being used in the system.)

2) **Battery Maximum Recharge Rate** - default = 12A. (Bellcore specifications recommend a maximum charging rate of capacity (in Ampere-hours) divided by 20 hours; check the manufacturer's recommendation.)

**3)** **System Voltage** - measurement ≅ -54.00V dc (This is a measurement by the system of the dc output bus voltage.)

**4)** **LVD Option** - default = "Enable" (If the MX28B does not have an LVD installed, this should be changed to "Disable".)

**5)** **Rectifier Information** - Check the rectifier information displays to verify that all rectifiers installed can be viewed on the control unit display and that no rectifier alarms are active.

Section 6 provides location information for these parameters and how to make changes if required.

### 5.9.3 Full System Power Up

To complete a full system power up, perform the following steps

1) Turn **OFF** all the circuit breakers that supply ac power to the rectifiers in the MX28B dc power plant.

2) Turn on the external circuit breaker from the battery to the power plant.

3) Turn on all the circuit breakers that supply ac power to the rectifiers in the MX28B dc power plant.

4) Load circuit breakers may now be turned on as required.

# 6. SETUP, ADJUSTMENTS, AND OPERATION

## 6.1 User Interface

The MX28B control unit provides a user interface designed with a hierarchical menu that can be viewed on the 32-character display by "navigating" with the "⇦" (left), "⇨" (right), "⇧" (up), and "⇩" (down) arrow keys located on the front panel. The selected item on the display is identified by the cursor cycling beneath its characters.

The "M" (modify) key and the arrow keys are used to set parameters and text to customize the system operation for a specific application. Items that can be modified have "m+" in the upper right corner of the display. (If a security level higher than the one presently set is required to modify the parameter, "s+" is displayed instead of "m+".) Status, alarms, and information screens have "+" in the upper right corner of the display (or "#" in the case of rectifier information screens) and can not be modified. When ac power is initially applied, there is a 60-second period during which no alarms are reported.

Pressing the "M" key on the front panel will change the "m+" to "M+", indicating that the parameter can now be changed using the arrow keys. Some parameters can be changed to other predefined selections by pressing the up or down arrow keys to display an alternative selection. These parameters can be recognized after the "M" key is pressed by the cursor cycling beneath the characters of the selection. For other parameters, such as text and most numeric values, after the "M" key is pressed the cursor will be displayed under an individual character. The right or left arrow key is used to position the cursor below the character to be changed and the up or down arrow key is used to "spin" the digit or letter to the desired value. When the desired changes have been made to an individual parameter screen, the "M" key is pressed again; the "M+" changes back to "m+" and the new entry is stored in memory.

If the user plans to make any changes to system parameters, the first item that should be verified or entered is the appropriate password for the security level required for the parameters to be modified. Security level 2 enables modification of all variable system parameters, level 1 permits modification of some parameters; no security is required for viewing status items. The security level password is entered through the "PIN" screen. If no front panel keys are pressed for 60 minutes, the active password reverts to "0000" and " ADVANCE " begins to move about the display. Pressing any key returns the display to normal; the password must be re-entered if system parameters require changes.

Eleven LEDs are provided on the front panel of the control unit to indicate system status. Three LEDs grouped together vertically provide overall system status; they are "MAJOR", "MINOR", and "NORMAL", indicating the presence of a major alarm, a minor alarm, or normal operation. The other eight LEDs correspond to the active state of each of the alarm output relays and are labeled "ALM1"⋯"ALM6", "MIN", and "MAJ".

## 6.2 External Alarm Inputs

The four external alarm inputs (also referred to as "Input Relay Alarms") can be assigned a priority and routed or "mapped" to alarm output relays. Available assignments are "Ignore", "Major", "Minor", and "Relay 1" ⋯ "Relay 6". Screens for making the assignments are located at **[SYSTEM/IN-RLY/RLY-MAP]**. A user defined name or "alias" may also be assigned to each of these input alarms. Screens for making these assignments are located at **[SYSTEM/IN-RLY/ALIAS]**. For information on wiring connections to these inputs refer to Section 5.6.1.

## 6.3 Alarm Output Relays

There are eight alarm output relays designated Relay 1 through Relay 6, Minor, and Major, respectively. Various system parameters may be programmed to activate any of these alarm relays when set thresholds are exceeded or specific conditions occur. The first six relays can also be assigned a priority and routed or "mapped" to other output alarm relays. Available assignments are "Ignore", "Major", "Minor", and "Relay 1" ⋯ "Relay 6". Screens for making these assignments are located at **[SYSTEM/OUT-RLY/RLY-MAP]**. This feature makes it possible for a single alarm condition to activate multiple alarm output relays including the Minor or Major alarm relay. A user defined name or "alias" may also be assigned to each of the eight output relay alarms. Screens for making these assignments are located at **[SYSTEM/OUT-RLY/ALIAS]**. For information on making wiring connections to the alarm output relays refer to Section 5.6.2.

## 6.4 Parameter Locations, Descriptions, and Default Values

The location, description, and factory programmed default value for each of the MX28B system parameters is found in Table 6.4.1. The table also shows all of the status and information screens with typical displays. The location of a parameter screen is shown in brackets, for example: **[SYSTEM/IN-RLY/RLY-MAP]**. To find the parameters that can be accessed in this category, starting from the main menu screen, do the following:

1) Use the right or left arrow keys to position the cycling cursor below "SYSTEM".

2) Press the down arrow key once.

3) Use the right arrow key to position the cycling cursor below "IN-RLY".

4) Press the down arrow key once; the cursor will be cycling below "RLY-MAP".

5) Press the down arrow key (repeatedly if necessary) until the desired parameter screen is displayed (there are eight parameter screens in this category).

6) After making any desired changes (refer to Section 6.1 for the procedure), to return to the main menu press the up arrow key repeatedly.

If a parameter requires a level 1 or level 2 security access to permit changes to it, the security level will be found in braces, i.e. {2}, in the "PARAMETER" column of Table 6.4.1.

The complete menu structure shown in the order in which it is accessed from the control unit display is presented in outline form in Figure 6.4-1. Each indentation to the right represents a menu level below the indicated title.

## Table 6.4-1. Parameter Locations, Descriptions, and Default Values

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|---|---|---|
| **SYSTEM SETUP** | | |
| **Password Entry** | | |
| PIN Entry<br>**[PIN]** | Screen for entry of the active password (PIN). | **PIN m+<br>0000** |
| **Password Setup** | | |
| Level 1 PIN {2}<br>**[SYSTEM/SETUP]** | Password (PIN) that permits security Level 1 parameter changes - limited access. | **PIN 1 m+<br>1111** |
| Level 2 Password {2}<br>**[SYSTEM/SETUP]** | Password (PIN) that permits security Level 2 parameter changes - unlimited access. | **PIN 2 m+<br>2222** |
| **OEM Calibration** | | |
| OEM R Offset {2}<br>**[OEM]** | Voltage offset adjustment for factory calibration of voltage readings/settings. | **OEM R Offset m+<br>0.000 V** |
| OEM R Gain {2}<br>**[OEM]** | Voltage gain adjustment for factory calibration of voltage readings/settings. | **OEM R Gain m+<br>1.000 V** |
| OEM S Offset {2}<br>**[OEM]** | Current offset adjustment for factory calibration of battery current readings/settings. | **OEM S Offset m+<br>0.0 A** |
| OEM S Gain {2}<br>**[OEM]** | Current gain adjustment for factory calibration of battery current readings/settings. | **OEM S Gain m+<br>1.000 A** |
| **Site Address/Identification** | | |
| Address 1 {1}<br>**[SYSTEM/SETUP]** | Power plant address or identification - first line. | **Address 1 m+<br>Advance, Inc.** |
| Address 2 {1}<br>**[SYSTEM/SETUP]** | Power plant address or identification - second line. | **Address 2 m+<br>11035 Switzer Av** |
| Address 3 {1}<br>**[SYSTEM/SETUP]** | Power plant address or identification - third line. | **Address 3 m+<br>Dallas, TX.** |
| **Control Unit Setup & Info.** | | |
| Model Type {2}<br>**[SYSTEM/SETUP]** | Model type number for the MX28B dc power plant<br>**NOTE: Changing the model number causes the system to reinitialize.** | **Model m+<br>0001** |
| Temperature Scale {1}<br>**[SYSTEM/SETUP]** | Enables selection of Fahrenheit or Celsius temperature scale (Fahrenheit "OFF" displays readings in °C). | **Fahrenheit m+<br>OFF** |
| Control Unit Revision<br>**[SYSTEM/SETUP]** | Hardware revision level of the control unit. | **Cntrl Rev +<br>000002** |
| Firmware Version<br>**[SYSTEM/SETUP]** | Version number of the control unit firmware.<br>**NOTE: Actual firmware version number displayed is the current version as of the date of manufacture.** | **FW Version +<br>000131** |

## (Table 6.4-1. Parameter Locations, Descriptions, and Default Values)

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|---|---|---|
| Display Type **[SYSTEM/SETUP]** | Type number for the control unit display. | **Display Type + 000255** |
| **Date/Time Setup** | | |
| Date {1} **[SYSTEM/DATE]** | Internal system calendar date. | **Date m+ DEC 16 1999** |
| Time {1} **[SYSTEM/DATE]** | Internal system clock time (24-hour format). | **Time m+ 9:00:25** |
| **Alarm Threshold Setup** | | |
| High Voltage Threshold {1} **[SYSTEM/SET-ALM]** | System High voltage alarm threshold. | **Sys HV Thr m+ -58.00 V** |
| Low Voltage Threshold {1} **[SYSTEM/SET-ALM]** | System Low voltage alarm threshold. | **Sys LV Thr m+ -50.00 V** |
| High Temperature Threshold {1} **[SYSTEM/SET-ALM]** | Over temperature alarm threshold. | **Sys HT Thr m+ 70.0 C** |
| Low Temperature Threshold {1} **[SYSTEM/SET-ALM]** | Under temperature alarm threshold. | **Sys LT Thr m+ 0.0 C** |
| **System Status** | | |
| System Voltage **[STATUS]** | System output voltage measured between the MX28B dc power plant -48V and return buses. | **Sys Voltage + -54.00 V** |
| System Current **[STATUS]** | The total system output current (calculated as the sum of the individual rectifier output currents). | **Sys Current + 145.8 A** |
| System Temperature **[STATUS]** | System temperature measured within the control unit. | **Sys Temp + 26.7 C** |
| Battery Current **[STATUS]** | Battery current measured at the current shunt. | **Batt Current + -15.0 A** |
| Battery Temperature **[STATUS]** | Battery temperature measured by the optional battery temperature sensor probe. | **Batt Temp + 25.2 C** |
| **System Alarms** | | |
| System High Voltage {1} **[SYSTEM/SET-ALM]** | System voltage is above the high voltage threshold. | **Sys HV Alm m+ Minor** |
| System Low Voltage {1} **[SYSTEM/SET-ALM]** | System voltage is below the low-voltage threshold. | **Sys LV Alm m+ Minor** |
| System High Temperature {1} **[SYSTEM/SET-ALM]** | The control unit temperature is above the high temperature threshold. | **Sys HT Alm m+ Minor** |

## (Table 6.4-1. Parameter Locations, Descriptions, and Default Values)

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|---|---|---|
| System Low Temperature {1} **[SYSTEM/SET-ALM]** | The control unit temperature is below the low temperature threshold. | **Sys LT Alm m+ Minor** |
| Rectifier Configuration {1} **[SYSTEM/SET-ALM]** | The rectifier configuration differs from its stored configuration. | **Rect Cfg Alm m+ Minor** |
| Rectifier Fail 1-of-N {1} **[SYSTEM/SET-ALM]** | Rectifier Fail 1-of-N alarm - one rectifier has at least one alarm condition. | **Rect 1ofN Alm m+ Minor** |
| Rectifier Fail 2-of-N {1} **[SYSTEM/SET-ALM]** | Rectifier Fail 2-of-N alarm – two or more rectifiers have at least one alarm condition each. | **Rect 2ofN Alm m+ Major** |
| Hardware System Voltage {2} **[SYSTEM/SET-ALM]** | This alarm indicates there is a hardware failure in the system voltage monitoring function. | **Hw Sys V Alm m+ Minor** |
| Hardware Battery Current {2} **[SYSTEM/SET-ALM]** | This alarm indicates there is a hardware failure in the battery current monitoring function. | **Hw Batt C Alm m+ Minor** |
| Hardware Battery Temperature {2} **[SYSTEM/SET-ALM]** | This alarm indicates there is a hardware failure in the battery temperature monitoring function. | **Hw Batt T Alm m+ Minor** |
| Hardware System Temperature {2} **[SYSTEM/SET-ALM]** | This alarm indicates there is a hardware failure in the system temperature monitoring function. | **Hw Sys T Alm m+ Minor** |
| Hardware LVD {2} **[SYSTEM/SET-ALM]** | This alarm indicates there is a conflict between the commanded and sensed positions of the LVD. | **Hw LVD Alm m+ Minor** |
| **SYSTEM ALARMS DISPLAY** | | |
| Alarms Item 1 **[ALARMS]** | Display of up to 16 active alarms (a typical alarm screen is shown). | **Alarm Item 1 + Batt LV Alm On m** |
| • • • | • • • | • • • |
| Alarms Item 16 **[ALARMS]** | Display of up to 16 active alarms (a typical alarm screen is shown). | **Alarm Item 16 +** |
| **SYSTEM DIAGNOSTICS** | | |
| Store Configuration {1} **[SYSTEM/DIAG]** | Setting this parameter to “Enable” will cause the current rectifier configuration to be stored (the display toggles back to “Disable” after entry). | **Store Cfg m+ Disable** |
| Lamp Test {1} **[SYSTEM/DIAG]** | Setting Lamp Test to “ON” will turn on the “MAJOR”, “MINOR”, “NORMAL”, “MAJ”, and “MIN” LEDs on the control unit front panel. | **Lamp Test m+ OFF** |
| Test Relay Enable {1} **[SYSTEM/DIAG]** | This parameter must be set to “Enable” to permit the eight output relays to be manually tested; otherwise, the state of the relays will be per system conditions. | **Test Relay En m+ Disable** |
| Test Relay 1 {1} **[SYSTEM/DIAG]** | Setting this parameter to “ON” energizes Relay 1 and turns on the “ALM1” LED on the control unit front panel. | **Test Relay 1 m+ OFF** |

## (Table 6.4-1. Parameter Locations, Descriptions, and Default Values)

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|---|---|---|
| • • • | • • • | • • • |
| Test Relay 6 {1} **[SYSTEM/DIAG]** | Setting this parameter to "ON" energizes Relay 6 and turns on the "ALM6" LED on the control unit front panel. | **Test Relay 6 m+ OFF** |
| Test Minor Relay {1} **[SYSTEM/DIAG]** | Setting this parameter to "ON" energizes the Minor Relay and turns on the "MIN" LED on the control unit front panel. | **Test Min Rly m+ OFF** |
| Test Major Relay {1} **[SYSTEM/DIAG]** | Setting this parameter to "ON" de-energizes the Major Relay and turns on the "MAJ" LED on the control unit front panel. | **Test Maj Rly m+ OFF** |
| **BATTERY SETUP** | | |
| Float Voltage {1} **[BATT/PARAM]** | Float voltage at 25°C battery temperature. | **Batt Float m+ -54.00 V** |
| Maximum Recharge Current {1} **[BATT/PARAM]** | Maximum battery recharge current (the system limits the charging current to this programmable value). | **Batt Max Rech m+ 12 A** |
| Compensation Method {1} **[BATT/COMP]** | Activate "000001" or de-activate "000000" battery temperature compensation. | **Comp Method m+ 000000** |
| Temperature Compensation {1} **[BATT/COMP]** | Temperature compensation between low knee and high knee in mV/cell/°C. (Compensation equals zero at 25°C.) | **Comp TC m+ - 3.00mV** |
| Compensation High Knee {1} **[BATT/COMP]** | The temperature compensation high knee is the point above which there is no additional battery voltage compensation for further increases in temperature. | **Comp Hknee m+ 40.0 C** |
| Compensation Low Knee {1} **[BATT/COMP]** | The temperature compensation low knee is the point below which there is no additional battery voltage compensation for further decreases in temperature. | **Comp Lknee m+ 0.0 C** |
| Discharge Threshold {1} **[BATT/SET-ALM]** | An alarm is generated if the battery discharge current exceeds this value. | **Batt Disc Thr m+ 10 A** |
| High Voltage Threshold {1} **[BATT/SET-ALM]** | An alarm is generated if the magnitude of the battery voltage rises above this value. | **Batt HV Thr m+ -58.00 V** |
| Low Voltage Threshold {1} **[BATT/SET-ALM]** | An alarm is generated if the magnitude of the battery voltage drops below this value. | **Batt LV Thr m+ -44.00 V** |
| High Temperature Threshold {1} **[BATT/SET-ALM]** | An alarm is generated if the battery temperature exceeds this value. | **Batt HT Thr m+ 70.0 C** |
| Low Temperature Threshold {1} **[BATT/SET-ALM]** | An alarm is generated if the battery temperature drops below this value. | **Batt LT Thr m+ 0.0 C** |
| **Battery Alarms** | | |
| Discharge Alarm {1} **[BATT/SET-ALM]** | An alarm that is generated if the battery discharge current exceeds the programmed battery discharge threshold. | **Batt Disc Alm m+ Minor** |

## (Table 6.4-1. Parameter Locations, Descriptions, and Default Values)

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|---|---|---|
| High Voltage Alarm {1} **[BATT/SET-ALM]** | An alarm that is generated if the magnitude of the battery voltage rises above the high voltage threshold. | **Batt HV Alm m+ Minor** |
| Low Voltage Alarm {1} **[BATT/SET-ALM]** | An alarm that is generated if the magnitude of the battery voltage drops below the low voltage threshold. | **Batt LV Alm m+ Minor** |
| High Temperature Alarm {1} **[BATT/SET-ALM]** | An alarm that is generated if the battery temperature exceeds the high temperature threshold. | **Batt HT Alm m+ Minor** |
| Low Temperature Alarm {1} **[BATT/SET-ALM]** | An alarm that is generated if the battery temperature drops below the low temperature threshold. | **Batt LT Alm m+ Minor** |
| **RECTIFIER SETUP** | | |
| Fail Safe Voltage {1} **[MODULES/RECT/PARAM]** | Rectifier default output voltage if communication with the control unit fails. | **Rect Fail Safem+ -54.00 V** |
| Communications Timeout {1} **[MODULES/RECT/PARAM]** | The maximum rectifier communications response time allowed before a communications failure is declared. | **Rect Fail Commm+ 1 min** |
| **Rectifier Information** | **NOTE: This information can be viewed for each rectifier installed by using the horizontal arrow keys.** | |
| Rectifier Description **[MODULES/RECT/INFO]** | Displays the model number of the installed rectifier. | **Rect 1 Desc # MRF28H54** |
| Rectifier Current **[MODULES/RECT/INFO]** | A display of the dc output current for the individual rectifier. | **Rect 1 Curr # 24.9 A** |
| Current Limit Alarm **[MODULES/RECT/INFO]** | The status will be “ON” if the rectifier has been forced into its current limited mode. | **Rect 1 CL # OFF** |
| Standby Alarm **[MODULES/RECT/INFO]** | The status will be “ON” if the control unit is holding the rectifier in the standby mode. | **Rect 1 Stdby # OFF** |
| Fan Fail Alarm **[MODULES/RECT/INFO]** | The status will be “ON” if the rectifier fan has failed. | **Rect 1 FF # OFF** |
| Rectifier Fault Alarm (RFA) **[MODULES/RECT/INFO]** | The status will be on if the rectifier output has failed. | **Rect 1 RFA # OFF** |
| **Rectifier Alarms** | | |
| Current Limit Alarm {1} **[MODULES/RECT/SET-ALM]** | This alarm indicates that a rectifier has been forced into the current limited mode. | **Rect CL Alm m+ n of N** |
| Standby Alarm {1} **[MODULES/RECT/SET-ALM]** | This alarm indicates that the control unit is holding a rectifier in the standby mode. | **Rect Stdby Almm+ n of N** |
| Fan Fail Alarm {1} **[MODULES/RECT/SET-ALM]** | This alarm indicates that a rectifier fan has failed. | **Rect FF Alm m+ n of N** |

## (Table 6.4-1. Parameter Locations, Descriptions, and Default Values)

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|---|---|---|
| RFA Alarm {1}<br>**[MODULES/RECT/SET-ALM]** | This alarm indicates that a rectifier output has failed. | **Rect RFA Alm m+<br>n of N** |
| **CIRCUIT BREAKER SETUP** | | |
| Breaker 1 Alias {1}<br>**[MODULES/CIRBKR/ALIAS]** | An alternate name (alias) that can be assigned to a circuit breaker if desired. | **Cir Bkr 1 m+<br>-48V** |
| •<br>•<br>• | •<br>•<br>• | •<br>•<br>• |
| Breaker 24 Alias {1}<br>**[MODULES/CIRBKR/ALIAS]** | An alternate name (alias) that can be assigned to a circuit breaker if desired. | **Cir Bkr 24 m+<br>-48V** |
| **Circuit Breaker Alarms** | | |
| Breaker 1 Tripped {1}<br>**[MODULES/CIRBKR/SET-ALM]** | An alarm that indicates Circuit Breaker 1 is tripped. | **Cir Bkr 1 Alm m+<br>Major** |
| •<br>•<br>• | •<br>•<br>• | •<br>•<br>• |
| Breaker 24 Tripped {1}<br>**[MODULES/CIRBKR/SET-ALM]** | An alarm that indicates Circuit Breaker 24 is tripped. | **Cir Bkr 24 Almm+<br>Major** |
| **GMT FUSE SETUP** | | |
| GMT 1 Alias {1}<br>**[MODULES/GMT/ALIAS]** | An alternate name (alias) that can be assigned to a GMT Fuse 1 if desired. | **GMT 1 +<br>-48V** |
| •<br>•<br>• | •<br>•<br>• | •<br>•<br>• |
| GMT 8 Alias {1}<br>**[MODULES/GMT/ALIAS]** | An alternate name (alias) that can be assigned to a GMT Fuse 8 if desired. | **GMT 8 +<br>-48V** |
| **GMT Fuse Alarms** | | |
| GMT 1 Blown {1}<br>**[MODULES/GMT/SET-ALM]** | An alarm that indicates GMT Fuse 1 is blown. | **GMT 1 Alm m+<br>Major** |
| •<br>•<br>• | •<br>•<br>• | •<br>•<br>• |
| GMT 8 Blown {1}<br>**[MODULES/GMT/SET-ALM]** | An alarm that indicates GMT Fuse 8 is blown. | **GMT 8 Alm m+<br>Major** |

## (Table 6.4-1. Parameter Locations, Descriptions, and Default Values)

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|---|---|---|
| **INPUT RELAY SETUP** | | |
| Input Relay 1 Alias {1}<br>**[SYSTEM/IN-RLY/ALIAS]** | An alternate name (alias) can be assigned to the relay if desired. | **In-Rly 1 m+**<br>**Input Relay 1** |
| •<br>•<br>• | •<br>•<br>• | •<br>•<br>• |
| Input Relay 4 Alias {1}<br>**[SYSTEM/IN-RLY/ALIAS]** | An alternate name (alias) can be assigned to the relay if desired. | **In-Rly 4 m+**<br>**Input Relay 4** |
| **Input Relay Alarms** | | |
| Input Relay 1 {1}<br>**[SYSTEM/IN-RLY/RLY-MAP]** | An alarm activated in response to an external contact closure or opening at the Input Relay 1 connection. | **In-Rly 1 Alm m+**<br>**Ignore** |
| •<br>•<br>• | •<br>•<br>• | •<br>•<br>• |
| Input Relay 4 {1}<br>**[SYSTEM/IN-RLY/RLY-MAP]** | An alarm activated in response to an external contact closure or opening at the Input Relay 4 connection. | **In-Rly 4 Alm m+**<br>**Ignore** |
| **OUTPUT RELAY SETUP** | | |
| Output Relay 1 Alias {1}<br>**[SYSTEM/OUT-RLY/ALIAS]** | An alternate name (alias) can be assigned to the relay if desired. | **Out-Rly 1 m+**<br>**Relay 1** |
| •<br>•<br>• | •<br>•<br>• | •<br>•<br>• |
| Output Relay 6 Alias {1}<br>**[SYSTEM/OUT-RLY/ALIAS]** | An alternate name (alias) can be assigned to the relay if desired. | **Out-Rly 6 m+**<br>**Relay 6** |
| Output Relay Minor Alias {1}<br>**[SYSTEM/OUT-RLY/ALIAS]** | An alternate name (alias) can be assigned to the relay if desired. | **Relay Minor m+**<br>**Minor** |
| Output Relay Major Alias {1}<br>**[SYSTEM/OUT-RLY/ALIAS]** | An alternate name (alias) can be assigned to the relay if desired. | **Relay Major m+**<br>**Major** |
| Output Relay 1 Delay {1}<br>**[SYSTEM/OUT-RLY/RLY-MAP]** | Delay between sensing of the alarm condition and activation of the alarm relay. An alarm condition must exist for longer than the delay to be activated. | **Out-Rly 1 Dly m+**<br>**0 sec** |
| •<br>•<br>• | •<br>•<br>• | •<br>•<br>• |
| Output Relay 6 Delay {1}<br>**[SYSTEM/OUT-RLY/RLY-MAP]** | Delay between sensing of the alarm condition and activation of the alarm relay. An alarm condition must exist for longer than the delay to be activated. | **Out-Rly 6 Dly m+**<br>**0 sec** |

## (Table 6.4-1. Parameter Locations, Descriptions, and Default Values)

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|---|---|---|
| **Output Relay Alarms** | | |
| Output Relay 1 {1}<br>**[SYSTEM/OUT-RLY/RLY-MAP]** | Output Relay 1 alarm can be "mapped" to activate other output relays ("Ignore" activates no additional relays). | **Out-Rly 1 Alm m+<br>Ignore** |
| •<br>•<br>• | •<br>•<br>• | •<br>•<br>• |
| Output Relay 6 {1}<br>**[SYSTEM/OUT-RLY/RLY-MAP]** | Output Relay 6 alarm can be "mapped" to activate other output relays ("Ignore" activates no additional relays). | **Out-Rly 6 Alm m+<br>Ignore** |
| **LVD SETUP** | | |
| LVD Trip {1}<br>**[MODULES/LVD/PARAM]** | LVD trip (disconnect) threshold voltage. | **LVD Trip m+<br>-42.00 V** |
| LVD Restore {1}<br>**[MODULES/LVD/PARAM]** | LVD restore (reconnect) threshold voltage. | **LVD Reset m+<br>-48.00 V** |
| LVD Option {1}<br>**[MODULES/LVD/SET-ALM]** | Set to "Enable" if the unit has an LVD. | **LVD Option m+<br>Enable** |
| **LVD Alarm** | | |
| LVD Alarm {1}<br>**[MODULES/LVD/SET-ALM]** | Sets the priority or "mapping" of an LVD Alarm. | **LVD Open Alm m+<br>Minor** |

**Figure 6.4-1. Control Unit Menu Structure**

```
MX28B          +
    STATUS
        Sys Voltage
        Sys Current
        Sys Temp
        Batt Current
        Batt Temp
    ALARMS
        Alarm Item 1
        Alarm Item 2
        Alarm Item 3
        Alarm Item 4
        Alarm Item 5
        Alarm Item 6
        Alarm Item 7
        Alarm Item 8
        Alarm Item 9
        Alarm Item 10
        Alarm Item 11
        Alarm Item 12
        Alarm Item 13
        Alarm Item 14
        Alarm Item 15
        Alarm Item 16
    SYSTEM
        SET-ALM
            Sys HV Thr
            Sys HV Alm
            Sys LV Thr
            Sys LV Alm
            Rect Cfg Alm
            Rect 1ofN Alm
            Rect 2ofN Alm
            Sys HT Thr
            Sys HT Alm
            Sys LT Thr
            Sys LT Alm
            Hw Sys V Alm
            Hw Batt C Alm
            Hw Batt T Alm
            Hw Sys T Alm
            Hw LVD Alm
        SETUP
            PIN 1
            PIN 2
            Address 1
            Address 2
```

**(Figure 6.4-1. Control Unit Menu Structure)**

```
        Address 3
        Model
        Fahrenheit
        Cntrl Rev
        FW Version
        Display Type
    DATE
        Date
        Time
    OUT-RLY
        RLY-MAP
            Out-Rly 1 Alm
            Out-Rly 2 Alm
            Out-Rly 3 Alm
            Out-Rly 4 Alm
            Out-Rly 5 Alm
            Out-Rly 6 Alm
            Out-Rly 1 Dly
            Out-Rly 2 Dly
            Out-Rly 3 Dly
            Out-Rly 4 Dly
            Out-Rly 5 Dly
            Out-Rly 6 Dly
        ALIAS
            Out-Rly 1
            Out-Rly 2
            Out-Rly 3
            Out-Rly 4
            Out-Rly 5
            Out-Rly 6
            Relay Minor
            Relay Major
    IN-RLY
        RLY-MAP
            In-Rly 1 Alm
            In-Rly 2 Alm
            In-Rly 3 Alm
            In-Rly 4 Alm
        ALIAS
            In-Rly 1
            In-Rly 2
            In-Rly 3
            In-Rly 4
    DIAG
        Store Cfg
        Lamp Test
        Test Relay En
```

**(Figure 6.4-1. Control Unit Menu Structure)**

```
            Test Relay 1
            Test Relay 2
            Test Relay 3
            Test Relay 4
            Test Relay 5
            Test Relay 6
            Test Min Rly
            Test Maj Rly
    MODULES
        RECT
            SET-ALM
                Rect CL Alm
                Rect Stdby Alm
                Rect FF Alm
                Rect RFA Alm
            PARAM
                Rect Fail Safe
                Rect Fail Comm
            INFO
                Rect # Desc
                Rect # Curr
                Rect # CL
                Rect # Stdby
                Rect # FF
                Rect # RFA
        CIRBKR
            SET-ALM
                Cir Bkr 1 Alm
                Cir Bkr 2 Alm
                Cir Bkr 3 Alm
                Cir Bkr 4 Alm
                Cir Bkr 5 Alm
                Cir Bkr 6 Alm
                Cir Bkr 7 Alm
                Cir Bkr 8 Alm
                Cir Bkr 9 Alm
                Cir Bkr 10 Alm
                Cir Bkr 11 Alm
                Cir Bkr 12 Alm
                Cir Bkr 13 Alm
                Cir Bkr 14 Alm
                Cir Bkr 15 Alm
                Cir Bkr 16 Alm
                Cir Bkr 17 Alm
                Cir Bkr 18 Alm
                Cir Bkr 19 Alm
                Cir Bkr 20 Alm
```

**(Figure 6.4-1. Control Unit Menu Structure)**

```
                Cir Bkr 21 Alm
                Cir Bkr 22 Alm
                Cir Bkr 23 Alm
                Cir Bkr 24 Alm
            ALIAS
                Cir Bkr 1
                Cir Bkr 2
                Cir Bkr 3
                Cir Bkr 4
                Cir Bkr 5
                Cir Bkr 6
                Cir Bkr 7
                Cir Bkr 8
                Cir Bkr 9
                Cir Bkr 10
                Cir Bkr 11
                Cir Bkr 12
                Cir Bkr 13
                Cir Bkr 14
                Cir Bkr 15
                Cir Bkr 16
                Cir Bkr 17
                Cir Bkr 18
                Cir Bkr 19
                Cir Bkr 20
                Cir Bkr 21
                Cir Bkr 22
                Cir Bkr 23
                Cir Bkr 24
        GMT
            SET-ALM
                GMT 1 Alm
                GMT 2 Alm
                GMT 3 Alm
                GMT 4 Alm
                GMT 5 Alm
                GMT 6 Alm
                GMT 7 Alm
                GMT 8 Alm
            ALIAS
                GMT 1
                GMT 2
                GMT 3
                GMT 4
                GMT 5
                GMT 6
                GMT 7
```

**(Figure 6.4-1. Control Unit Menu Structure)**

```
                GMT 8
        LVD
            SET-ALM
                LVD Option
                LVD Open Alm
            PARAM
                LVD Trip
                LVD Reset
    BATT
        SET-ALM
            Batt Disc Thr
            Batt Disc Alm
            Batt HV Thr
            Batt HV Alm
            Batt LV Thr
            Batt LV Alm
            Batt HT Thr
            Batt HT Alm
            Batt LT Thr
            Batt LT Alm
        PARAM
            Batt Float
            Batt Max Rech
        COMP
            Comp Method
            Comp TC
            Comp HKnee
            Comp LKnee
    PIN
        PIN
    OEM
        OEM R Offset
        OEM R Gain
        OEM S Offset
        OEM S Gain
```